

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

- 1 1. (Currently amended) A method for supporting read-only objects
2 within an object-addressed memory hierarchy, comprising:
3 receiving a request at a translator to access an object, wherein the request
4 includes an object identifier for the object that is used to reference the object
5 within the object-addressed memory hierarchy, and wherein the translator
6 converts an object identifier and offset into a corresponding physical address and
7 converts the request to access an object into a request for the corresponding
8 physical address;~~translates between object identifiers (used to reference objects in~~
9 ~~an object cache) and a physical addresses (used to address objects in main~~
10 ~~memory);~~
11 using the object identifier to retrieve an object table entry associated with
12 the object;
13 if the request is a write request,
14 examining a read-only indicator within the object table
15 entry,
16 if the read-only indicator specifies that the object is a read-
17 only object, performing a corrective action to deal with the fact that
18 the write request is directed to a read-only object.

1 2. (Original) The method of claim 1, wherein if the request is a read
2 request, the method further comprises using a physical address from the object
3 table entry to access the object in main memory.

1 3. (Original) The method of claim 1, wherein performing the
2 corrective action can involve causing a fault handler in the requesting processor to
3 perform the corrective action.

1 4. (Original) The method of claim 1, wherein performing the
2 corrective action can involve:
3 obtaining a writable copy of the object, clearing the read-only indicator to
4 indicate that the object is no longer read-only, and updating the writable copy of
5 the object with data from the write request;
6 updating a remotely located master copy of the object with data from the
7 write request;
8 terminating the requesting process because the write request is not
9 allowed; and
10 if the request is directed to a debugging breakpoint, pausing the requesting
11 process and clearing the read-only indicator.

1 5. (Cancelled)

1 6. (Previously presented) The method of claim 1,
2 wherein prior to receiving the request at the translator, the request is
3 initially directed to the object cache;
4 wherein if the request causes a hit in the object cache, the object is
5 accessed in the object cache and the request is not sent to the translator; and

6 wherein if the request causes a miss in the object cache, the request is sent
7 to the translator.

1 7. (Original) The method of claim 6, further comprising making a
2 given object read-only by:
3 setting a read-only indicator associated with the given object to indicate
4 that the given object is read-only;
5 causing all object caches within a local cache-coherent domain to flush any
6 modified cache lines of the given object out to main memory;
7 whereby subsequent upgrades of the given object from read-only status to
8 writable or modified status in any caches within the local cache-coherent domain
9 must go through a translator.

1 8. (Original) The method of claim 7, wherein causing all object
2 caches within the local cache-coherent domain to flush any modified cache lines
3 of the given object out to main memory involves executing a read-with-intent-to-
4 only-read (RWITOR) instruction on each cache line of the given object.

1 9. (Original) The method of claim 7, wherein the given object can be
2 made read-only in response to a request received from outside the local cache-
3 coherent domain.

1 10. (Previously presented) The method of claim 1, wherein the
2 translator includes hardware to translate between object identifiers and physical
3 addresses.

1 11. (Currently amended) An apparatus that supports read-only objects
2 within an object-addressed memory hierarchy, comprising:

3 a receiving mechanism configured to receive a request at a translator to
4 access an object, wherein the request includes an object identifier for the object
5 that is used to reference the object within the object-addressed memory hierarchy,
6 and wherein the translator converts an object identifier and offset into a
7 corresponding physical address and converts the request to access an object into a
8 request for the corresponding physical address;~~translates between object~~
9 ~~identifiers (used to reference objects in an object cache) and a physical addresses~~
10 ~~(used to address objects in main memory);~~
11 a translation mechanism configured to use the object identifier to retrieve
12 an object table entry associated with the object; and
13 a corrective action mechanism, wherein if the request is a write request,
14 the corrective action mechanism is configured to,
15 examine a read-only indicator within the object table entry,
16 and
17 if the read-only indicator specifies that the object is a read-
18 only object, to perform a corrective action to deal with the fact that
19 the write request is directed to a read-only object.

1 12. (Original) The apparatus of claim 11, wherein if the request is a
2 read request, the translation mechanism is additionally configured to use a
3 physical address from the object table entry to access the object in main memory.

1 13. (Original) The apparatus of claim 11, wherein the corrective action
2 mechanism is configured to cause a fault handler in the requesting processor to
3 perform the corrective action.

1 14. (Original) The apparatus of claim 11, wherein performing the
2 corrective action can involve:

3 obtaining a writable copy of the object, clearing the read-only indicator to
4 indicate that the object is no longer read-only, and updating the writable copy of
5 the object with data from the write request;
6 updating a remotely located master copy of the object with data from the
7 write request;
8 terminating the requesting process because the write request is not
9 allowed; and
10 if the request is directed to a debugging breakpoint, pausing the requesting
11 process and clearing the read-only indicator.

1 15. (Cancelled)

1 16. (Previously presented) The apparatus of claim 11, wherein the
2 apparatus includes the object cache;
3 wherein prior to receiving the request at the translator, the request is
4 initially directed to the object cache;
5 wherein if the request causes a hit in the object cache, the object is
6 accessed in the object cache and the request is not sent to the translator; and
7 wherein if the request causes a miss in the object cache, the request is sent
8 to the translator.

1 17. (Original) The apparatus of claim 16, further comprising a read-
2 only configuration mechanism configured to make a given object read-only by:
3 setting a read-only indicator associated with the given object to indicate
4 that the given object is read-only; and
5 causing all object caches within a local cache-coherent domain to flush
6 any modified cache lines of the given object out to main memory;

7 whereby subsequent upgrades of the given object from read-only status to
8 writable or modified status in any caches within the local cache-coherent domain
9 must go through a translator.

1 18. (Original) The apparatus of claim 17, wherein the read-only
2 configuration mechanism causes all object caches within the local cache-coherent
3 domain to flush any modified cache lines of the given object out to main memory
4 by executing a read-with-intent-to-only-read (RWITOR) instruction on each cache
5 line of the given object.

1 19. (Original) The apparatus of claim 17, wherein the read-only
2 configuration mechanism makes the given object read-only in response to a
3 request received from outside the local cache-coherent domain.

1 20. (Previously presented) The apparatus of claim 11, wherein the
2 translator includes hardware to translate between object identifiers and physical
3 addresses.

1 21. (Currently amended) A computer system that supports read-only
2 objects within an object-addressed memory hierarchy, comprising:
3 a processor;
4 the object-addressed memory hierarchy;
5 an object cache within the object-addressed memory hierarchy;
6 a translator that translates between object identifiers, used to address
7 objects in the object cache, and physical addresses, used to address objects in
8 main memory;
9 a receiving mechanism within the translator configured to receive at the
10 translator a request to access an object, wherein the request includes an object

11 identifier for the object that is used to reference the object within the object-
12 addressed memory hierarchy, and wherein the translator converts an object
13 identifier and offset into a corresponding physical address and converts the
14 request to access an object into a request for the corresponding physical
15 address;~~translates between object identifiers (used to reference objects in an object~~
16 ~~cache) and a physical addresses (used to address objects in main memory);~~
17 a translation mechanism within the translator configured to use the object
18 identifier to retrieve an object table entry associated with the object; and
19 a corrective action mechanism, wherein if the request is a write request,
20 the corrective action mechanism is configured to,
21 examine a read-only indicator within the object table entry,
22 and
23 if the read-only indicator specifies that the object is a read-only object, to
24 perform a corrective action to deal with the fact that the write request is directed
25 to a read-only object.